

# AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY  
CITY OF NEW YORK      JANUARY 21, 1953      NUMBER 1607

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## A PLEISTOCENE MUSK-OX FROM NEW YORK AND THE DISTRIBUTION OF THE MUSK-OXEN

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### INTRODUCTION

Specimens of fossil *Ovibos* have been known and correctly identified since 1831 (Beechey, 1831), but finds have been rare. At the present time only about 20 fossil specimens from North America have been recorded in the literature. This paper describes a partial skull of *Ovibos moschatus* from the gravel pit of the Barney and Dickinson Company located at Willow Point, Town of Vestal, Broome County, New York. In view of the rarity of fossil specimens of this genus, a description of the present specimen is believed to be justified, despite its fragmentary nature. The specimen is, furthermore, the first one to be found in New York State, although the former presence of *Ovibos* in this area might have been inferred from the fact that fossil specimens pertaining to this genus have been found in Pennsylvania, New Jersey, and southern Ontario.

Mr. Ralph Digman of the Department of Geology, Harpur College, has examined the locality at which the specimen was found. His help is gratefully acknowledged. The specimen was discovered at a depth of 8 feet in stratified drift. The material exposed in the pit is of glacial origin and of Wisconsin age. Mr. Digman states that from the character of the drift it appears to be correlative with the Binghamton drift of probable Cary substage.

The writer wishes to acknowledge the generosity of the Broome County Historical Society in presenting the specimen to the American Museum of Natural History. The writer is indebted to Mr. H. M. Van Deusen of the Department of Mammals of this Museum

for the opportunity to examine Recent specimens of this genus, and to Dr. G. G. Simpson for the opportunity to describe this specimen and for his helpful criticism.

#### DESCRIPTION

ORDER ARTIODACTYLA OWEN, 1848

FAMILY BOVIDAE GRAY, 1821

OVIPOS DE BLAINVILLE, 1816

**Ovibos moschatus** (Zimmerman), 1780

The specimen (A.M.N.H. No. 39550) consists of the posterior portion of the skull. The region in front of a line just posterior to the orbits is missing, as is the entire basilar portion. The specimen is greatly worn, undoubtedly as a result of having been transported in glacial streams. The greater part of the horn cores and the lateral edges of the exoccipitals have been worn away. The paramastoid processes, muscular processes, tympanic bullae, and the bases of the zygomatic processes are lacking. The dorsal part of the endocranium, however, is well preserved.

Enough of the skull remains to show the striking ovibovine specialization, namely, the pronounced rugosity of almost the entire dorsal surface of the cranial portion of the skull. This region is well preserved and shows little wear. A median groove separates the area of rugosity into lateral halves, a character typical of adult male individuals of the genus. Comparison of the specimen with the skulls of Recent adult males reveals no morphological differences that would warrant specific distinction.

Of the 17 fossil specimens from North America referable to the genus *Ovibos*, only three have been assigned to species other than *O. moschatus*.

Bensley (1923) provisionally designated a partial skull from the Iroquois Beach deposits of Toronto as the type of the species *O. proximus*, separating it from *O. moschatus* on the basis of the more compact and more transversely quadrate shape of the skull.

A nearly complete skull from the Palisades of the Yukon was designated as the type of *O. yukonensis* by Gidley (1908), who separated it from *O. moschatus* principally on the basis of the larger size and somewhat different proportions of the skull. The specimen differs further from the skull of *O. moschatus* in that the premaxillaries nearly reach the nasals, the basisphenoid

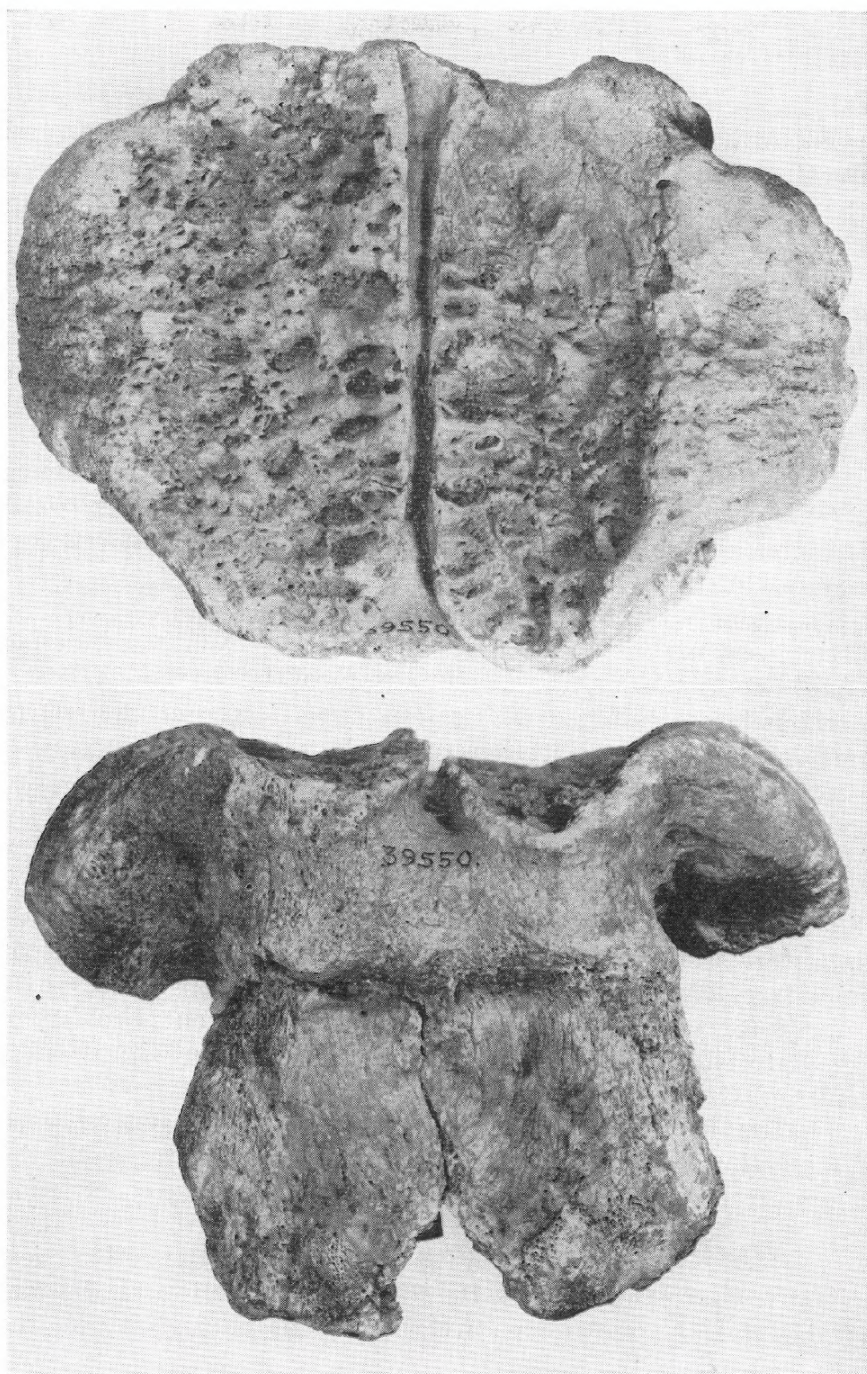


FIG. 1. *Ovibos moschatus*. A.M.N.H. No. 39550, cranial portion of skull. Top, dorsal view. Bottom, occipital view. Both approximately one-half natural size.



slightly overlaps the vomer, and the otic bullae are greatly reduced. Although this specimen is indeed slightly larger than the largest Recent skulls in the collections of this Museum, Allen (1913) believed that this specimen possibly fell within the limits of *O. moschatus*.

Rhoads (1895) described part of a horn core from Bucks County, Pennsylvania, to which he applied the name *Bison appalachicolus*. He later concluded (Rhoads, 1897) that the horn core had belonged to an animal of the genus *Oribos*, and consequently it bears the name *O. appalachicolus*. This specimen is probably too fragmentary for specific determination.

All of the above specimens closely resemble Recent specimens of *O. moschatus*, and it should be noted that the authors based their conclusions in each case on a comparison with only one Recent specimen.

Since many of the anatomical characters used to make specific distinctions in the above cases are missing from the Broome County specimen, no direct comparison can be made. The specimen has been compared with a sample of 15 Recent adult male musk-oxen from the collections of this Museum. These specimens were collected in Northern Grant Land by the Perry Arctic Expeditions and have been described and many of them figured by Allen (1913).

Owing to the condition of the fossil specimen, it was extremely difficult to obtain any useful measurements. The distances measured were selected simply because they were the only ones that could be defined with any degree of accuracy. Although necessarily somewhat crude, it is believed that the measurements provide an adequate basis for the comparison of the specimen with the Recent sample.

The four measurements made were: horizontal distance between the junction of the squamous and parieto-frontal sutures and the temporal crest (L); minimum width of the skull at the constriction just above the nuchal crest (W); vertical height from the dorsal lip of the foramen magnum to the nuchal crest ( $H_1$ ); and vertical height from the dorsal lip of the foramen magnum to the bottom of the median groove separating the areas of rugosity on the dorsal surface of the skull ( $H_2$ ).

Little comment regarding the comparison of the measurements seems necessary, since all of the measurements of the fossil specimen fall within the range of the Recent sample. This fact and the

lack of morphological distinction leave little doubt that the fossil specimen may be assigned to *O. moschatus*.

	RECENT SAMPLE			A.M.N.H.
	N	OR	M	No. 39550
L	15	85-98	91.8	96
W	15	101-131	113.9	120
H <sub>1</sub>	15	73-89	82.4	78
H <sub>2</sub>	15	94-124	105.5	111

All measurements are in millimeters.

N, number of measurements included.

OR, observed range.

M, mean.

#### DISTRIBUTION OF RECENT AND FOSSIL MUSK-OXEN

Pleistocene musk-oxen have been found at about 50 localities in North America. The great majority of these localities pertain to *Ovibos* and *Symbos*. Since specific criteria are not well defined in *Ovibos*, and *Symbos* localities for species other than *S. cavifrons* are so rare, a discussion of specific distribution has not been attempted. Although the general pattern of temporal distribution is evident, the exact dating of any single specimen is so uncertain that no detailed treatment of this problem has been included. Figure 2 shows the Pleistocene musk-ox localities by genus and the distribution of *Ovibos* both in the last century and at the present time. The maximum extent of continental glaciation during the Wisconsin is also shown.

All the fossil *Ovibos* localities are of late Pleistocene age and, with two exceptions, either north or just south of a line marking the maximum extent of glaciation during the Wisconsin. The Colorado occurrence, which is doubtful since the specimen consists of the well-worn distal end of a humerus, is within an area that was subject to mountain glaciation during the Pleistocene. Thus, with the exception of the locality in western Nebraska, all the *Ovibos* localities are within areas that were close to the edge of the ice sheet and presumably were covered by tundra at some time during the Wisconsin or early Recent. Furthermore, most of the deposits in which these specimens were found are of glacial origin. There is little reason to doubt that *Ovibos* was during the Pleistocene, as now, largely restricted to the areas of tundra at the edge of the ice sheet.

The range of *Ovibos* moved northward with the receding tundra and within the Recent was nearly circumpolar. Within historical times, although extinct in Europe, musk-oxen ranged from northern Alaska to the east coast of Greenland. During the nineteenth century, however, this range was much reduced, probably owing in

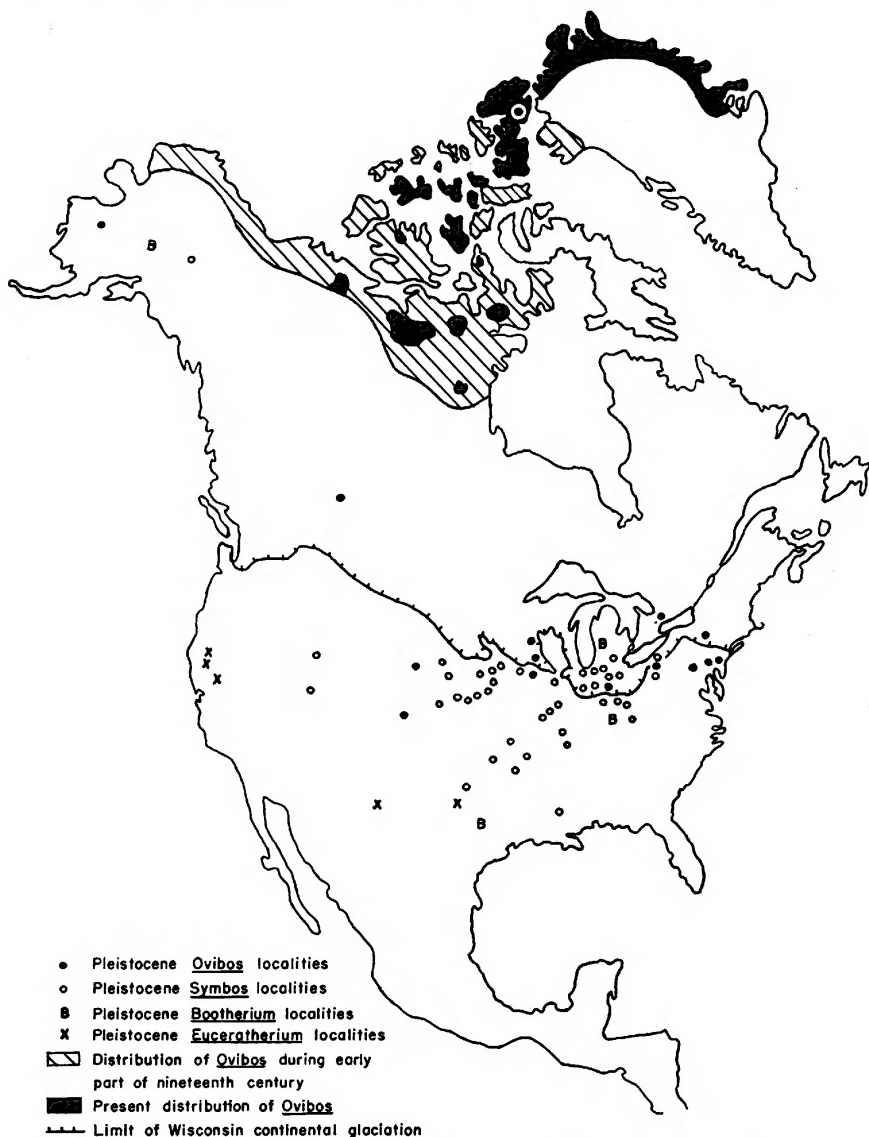


FIG. 2. Map of North America showing distribution of Recent and Pleistocene musk-oxen.

large part to the use of firearms by the Indians and Eskimos and to commercial hunting by trappers. Since 1917 musk-oxen have been protected by the Canadian government, and recent legislation by the Danish government has provided large preserve areas in Greenland. The musk-ox does not at present appear to be in any immediate danger of extinction. For discussions of the present status of the musk-ox, see Hone (1934) and Yarham (1951).

The distribution of *Symbos* differed from that of *Ovibos* both spatially and temporally. It was distinctly more southern and somewhat more western, and extended throughout the Pleistocene. The localities in Oklahoma, and particularly the one in Mississippi, clearly show that at least some of these animals occurred far south of the glacier in a relatively warm, non-tundra environment. On the other hand, although the stratigraphic position of most of the *Symbos* specimens was not accurately determined, in some cases the geologic evidence indicates that the animals were buried under conditions prevailing at the edge of the glacier. The *Symbos* localities appear to represent either a single far-ranging species of rather broad ecological tolerance or, what would seem to be more likely in view of our knowledge of Recent animals, two or more species or subspecies adapted to different climatic conditions. It is not necessary to conclude, however, that *Symbos* was adapted to both tundra and steppe. Evidence from pollen analysis and fish distribution (Deevey, 1949) suggests that the tundra belt peripheral to the ice sheet at its maximum was very narrow. It is possible that throughout its history *Symbos* was a woodland or steppe form despite the fact that it ranged close to the glacier.

It appears unlikely, furthermore, that *Ovibos* and *Symbos* occurred in exactly the same ecological niche. The two genera have never been found in association, but in view of the relative rarity of finds this fact could well be due to chance. Of course *Symbos* may have occupied the tundra area during the early and middle Pleistocene, to be replaced there by *Ovibos* at the beginning of the late Pleistocene. In this connection it should be noted that, to the knowledge of the writer, the only *Symbos* specimen that has certainly been associated with a glacial deposit is of Kansan age (Lugn and Schultz, 1934).

The genus *Euceratherium* was restricted to the west coast and the southwest, well isolated from other genera of musk-oxen.

The *Bootherium* localities, although very widely spread, are so

rare that no generalizations about the distribution of this genus are possible. This genus was apparently present throughout the Pleistocene.

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